Poster Displays

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Marsh Thanatocoenoses: Using Microfossils to Define Wetland Paleoenvironments, **Bradley E. Hoge**, Wetland Center for Biogeochemical Research, Rice University

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Wetland Losses and Gains In Response to Relative Sea-Level Rise, Galveston and Corpus Christi Bay Systems, **William A. White**, Bureau of Economic Geology, The University of Texas at Austin, **Thomas A. Tremblay**, Bureau of Economic Geology, The University of Texas at Austin

Wetlands Restoration at Galveston Island State Park a Multi-Agency Project, **Phil Glass**, U.S. Fish & Wildlife Service, Houston, TX

Wetland and Aquatic Habitat Restoration, Jumbile Cove, West Bay, **Woody Woodrow**, Texas Parks and Wildlife Department, Houston, TX

The Proposed Removal of the Brown Pelican Along the Gulf Coast from the Endangered and Threatened Species List, **Edith Erfling**, U.S. Fish and Wildlife, Clear Lake, TX

Survey of Benthic Macroinvertabrate and Microbial Communities in the Lower Houston Ship Channel, **Cindy Howard**, University of Houston - Clear Lake, Houston, TX

Field Evaluation of Ecotoxic Impacts to Clear Creek, **Cindy Howard**, University Of Houston - Clear Lake, Houston, TX

The Role of Stress Proteins in Pollution Tolerance of Grass Shrimp, **Cindy Howard**, University of Houston - Clear Lake, Houston, TX

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Bayport Demonstration Marsh - A Beneficial Use of Dredge Material, **Georganna B. Collins**, Turner Collie & Braden Inc., Houston, TX

The Importance of Episodic Events on Turbidity and the Mobility of Heavy Metals in Galveston Bay, **Gary A. Gill** and **Mead A. Allison**, Dept. of Marine Sciences, Texas A&M at Galveston, **Donald E. Harper**, Dept. of Marine Biology, Texas A&M at Galveston

Spring Shorebird Use at Brazoria National Wildlife Refuge Complex, Texas, **Richard T. Speer**, U.S. Fish & Wildlife Service, Angleton, TX

Development of a Black Skimmer and Least Tern Nesting Site at Brazoria National Wildlife Refuge, **Richard T. Speer**, U.S. Fish & Wildlife, Angleton, TX

Lafitte's Cove Water Quality Monitoring Program In Galveston Bay, Texas, **Debbie L. DeVore** and **André M. Landry**, Jr., Texas A&M University at Galveston, Galveston, TX

Galveston Bay's Disappearing Bird Islands, **Winifred Burkett**, Texas Audubon, Friendswood, TX, **Robert Gallaway**, Texas Audubon, Bacliff, TX

Brown Pelican's Return to Galveston Bay, **Winifred Burkett**, Texas Audubon, Friendswood, TX, **Robert Gallaway**, Texas Audubon, Bacliff, TX

Bioavailability of Colloidal Materials to Bivalves in Galveston Bay Waters, **Susan Gonzalez, Laodong Guo, Sammy Ray, and Peter Santschi**, Texas A & M University at Galveston, Galveston, TX

USGS/H-GAC Study to Characterize Water and Sediment-Quality in Christmas Bay, Brazoria County, Texas, 1998-1999, **Jeff East**, USGS.

Development and Construction of a Freshwater Treatment Wetland and an Intertidal Wetland Adjacent to the Houston Ship Channel, **W.D. Quast,** Benchmark Ecological Services, Inc., **C. Chang,** Radian International LLC, **J. L. Murray,** Agrifos Fertilizer L.P., **R. L. Davidson,** Benchmark Ecological Services, Inc., **J. R. Kovski,** Radian International LLP, **G. Williams,** Radian International LLP.

Restoration of Intertidal Wetlands Along the I-45 Corridor - Galveston, Texas **Robert Nailon**, ENTRIX, Inc., **Evangeline L. Whorton**, Scenic Galveston.

Student Presentations:

Effects of Bivalve Feeding on the Biomass and Composition of Natural Marine Plankton Communities, **Kristina Faulk**

An Examination of Bottlenose Dolphins (*Tursiops Truncatus*) In The Gulf of Mexico using Morphometrics and Hemoglobin Profiles: A Comparison of Techniques, **J.S. Turner and L.J. Lester**, University of Houston Clear Lake, Houston, TX, and **J.P. Turner and G.A. Worthy**, Texas A & M Univeristy - Galveston, Galvston, TX

Oyster Growth On An Artificial Substrate, **Tavia L. Clark**, Texas A&M University - Galveston, Galveston, TX

HOUSTON-GALVESTON NAVIGATION CHANNELS, TEXAS PROJECT BENEFICIAL USES OF DREDGED MATERIAL UPDATE

Alan R. Jefts, Turner Collie & Braden Inc., Houston, Texas

The Houston-Galveston Navigation Channels, Texas Project comprises 53 miles of widening and deepening of the navigation channel generating approximately 62 million cubic yards of new work dredging and 190 million cubic yards of maintenance dredging over the 50-year project life. A major feature of the project is the construction of approximately 4,582 acres of intertidal marsh creating ecologically productive habitat in Galveston Bay. In April 1992 construction began on the 220 acre Bayport Demonstration Marsh (Demo Marsh). The purpose of the Demo Marsh is to identify environmental and design parameters and management requirements needed for establishment, growth, and survival of created marsh. The construction of the Demo Marsh also validated the use of typical dredging equipment in the placement of dredged material for beneficial uses.

This presentation provides an update on the development of the Demo Marsh, the lessons learned, and management requirements. The information gathered from the Demonstration Marsh has been utilized in the design of the Lower Bay Beneficial Use Site at Bolivar Peninsula and will be utilized to design beneficial use sites at Atkinson Island and Midbay. The initial Lower Bay sites consist of approximately 540 acres of new work intertidal marsh adjacent to Bolivar Peninsula and a 12 acre Bird Island 1 mile offshore of the Bolivar Marsh. The Lower Bay project is scheduled to begin construction in early fall 1998, beginning with Bird Island.

MARSH THANATOCOENOSES: USING MICROFOSSILS TO DEFINE WETLAND PALEOENVIRONMENTS

Bradley E. Hoge, Wetland Center for Biogeochemical Research, Rice University, Houston, TX

Wetland microfossils are often used to study sea-level fluctuations, thoughmost studies examine a single taxonomic group and taphonomic controls areoften lacking. It is, therefore, difficult to interpret fine-scale changes due to time averaging and taphonomy. Biogeochemical influences during lifetime, preservation, and fossilization make it unlikely that any single taxonomic group will be preserved across all wetland environments, making it unclear whether patterns observed in death assemblages are due toecology or preservation. Studying taphonomic rather than taxonomic trendsprovides a more effective means of interpreting fine-scale changes since carbonaceous, siliceous, and proteinaceous species within and acrosstaxonomic groups often have different ecological requirements andtaphonomic signatures.

Foraminiferal assemblages occur in salt to brackish marshes but are absentin fresh marsh sediments. Arcellaceans occur in fresh marshes only, whileostracode and diatom assemblages occur in each marsh type. Eachthanatocoenosis is susceptible to unique taphonomic gradients. By comparing taphonomic trends across thanatocoenoses paleoenvironments can be determined within depositional sequences.

An analysis of taphonomic trends in wetlands surrounding Galveston Bay suggests the following model: During accretionary still stands, in situ preservation is high for each thanatocoenosis. This is due to time averaging over an otherwise harsh and patchy chemical environment. During rapid sea-level rise, fresh marsh sediments become inundated with brackish to salt water. This tends to raise the pH and Eh enhancing preservation. Thanatocoenoses grade sharply from mixed to distinct. During flooding or progradation, fresh water inundates brackish to salt water sediments. This tends to lower pH and Eh decreasing preservation. In situ thanatocoenoses are reduced to only a few species or eliminated completely.

BAY AMBASSADOR PROGRAM

Terry W. Tunks, Galveston Bay Foundation, Webster, Texas
Linda R. Shead, P.E., Galveston Bay Foundation, Webster, Texas

Since 1993, trained volunteers have visited over 28,000 students and teachers in the Galveston Bay community to present a classroom program designed to increase awareness and knowledge of Galveston Bay, its many uses, its importance to humans and nature, and to provide an introductory stepping stone to field excursions which further enhance a student's understanding of the complex interdependencies of the Bay ecosystem. Presentation materials and activities include map identification, a slide presentation, a water quality demonstration, a nonpoint source pollution demonstration, and inspection of Bay specimens.

This program is an important component of the Public Participation and Education Action Plan, bringing specific curricula to Galveston Bay watershed school districts and developing effective volunteer opportunities for citizens of the Galveston Bay community.

This presentation is available to the public and suitable for students K-12. Presentation solicitation and volunteer recruitment and training are ongoing.

TEXAS COLONIAL WATERBIRD CENSUS DATABASE

Cynthia Murray-Gulde, University of Houston-Clear Lake, Houston, TX

From 1973 to the present, biologists from federal, state and private organizations have directed a co-operative survey and census of waterbird colonies in Texas. The surveys were conducted at over 300 coastal and inland colonies and focused on 26 nesting bird species. The objective of this project was to compile the surveys taken from 1973 to 1996 and create a user-friendly computer database. The database contains information regarding map location and identification of each individual site, the colony name, the geographic coordinates, the observer, common species name and population count. Each of these variables may be used in a search so that specific parameters may be analyzed. This database is designed for general public use, however, it will be useful in wildlife management practices to locate new or abandoned sites, as well as monitor population trends at existing colonies.

SURVEY OF GRASS CARP (CTENOPHARYNGODON IDELLA) IN BRAYS BAYOU, WHITE OAKS BAYOU, AND THE SAN JACINTO RIVER

Martin J. Kelly III, University of Houston-Clear Lake, Webster, Texas

The grass carp (*Ctenopharyngodon idella*), a fish from the Family Cyprinidae, was stocked into Lake Conroe, Texas in 1981-82 as a biocontrol agent for nuisance aquatic vegetation. Texas Parks and Wildlife Department (TPWD) began to receive reports that grass carp were being caught in commercial fisherman's nets during 1981-82 in the Trinity River and Galveston Bay . Grass carp have expanded their local range and there is concern that reproduction in local bayous will increase their ecological impact. Grass carp that have migrated into upper Galveston Bay are believed to be consuming *Spartina alterniflora* and *Ruppia maritima*. The ecological integrity of the bay could be altered by this exotic herbivore.

Adult grass carp were collected from Brays Bayou in July 1997 and from Brays Bayou and the San Jacinto River in April 1998. The grass carp collected in 1997 and 1998 were analyzed for ploidy. Two fish out of the 17 collected in 1997 had mature ovaries. All of the 15 grass carp collected in 1998 had mature gonads. Ploidy of the grass carp collected in 1998 was determined from blood. Analysis of the blood cells showed them to be aneuploid. They exhibited DNA size characteristics between triploid and diploid. The amount of DNA was greater in fish from Brays Bayou than the San Jacinto. Spawning capability of the adult grass carp was determined by examining ichthyoplankton samples for the presence of grass carp eggs and larvae. Eggs of many fish were collected but fewer than 10 are presumed to be grass carp. More than 50 of the collected larvae have been classified to the Family Cyprinidae. The stomach contents of the adult grass carp were analyzed for the presence of major macrophyte species by use of gel electrophoresis. Protein markers unique to potential local food plants were identified. Plant species could not be identified from stomach enzymes had denatured the plant enzymes.

This study provides evidence of the reproduction of grass carp in selected Houston waterways, as well as ploidy differences across waterways.

PRELIMINARY STUDIES OF DIAMONDBACK TERRAPIN (*MALACLEMYS TERRAPIN*) POPULATIONS IN WEST BAY, GALVESTON AND NUECES BAY, CORPUS CHRISTI, TEXAS.

John A. Huffman, PBS&J Corporation, Houston, Texas
Lee Elliot, Texas Parks and Wildlife Department, Corpus Christi, Texas

The diamondback terrapin, *Malaclemys terrapin*, is a uniquely adapted emylid turtle that is specifically suited for life in the estuarine environment. Basic ecology of East Coast varieties has been well studied, however almost nothing is known of Texas populations. A mark-recapture study was initiated to provide preliminary information of terrapin populations in West Bay. The study was conducted from September to November 1997 in an expansive saltmarsh in West Bay in which diamondback terrapins had been documented. A similar study in Nueces Bay was initiated in June 1997. Methodologies of the two studies were similar. Modified crab traps baited with dead fish were used to capture the terrapins in both studies.

In West Bay, a total of 1,554 trap hours were accrued in one study area yielding the capture of one mature female terrapin. The Nueces Bay study yielded a total of 106 captures (83 females and 23 males) and 11 recaptures in 1,410 trap hours. When compared to the Nueces Bay capture-recapture rates during the same period, the data suggests West Bay populations were very small. Terrapins in the Nueces Bay study were captured in close proximity to oyster reefs and small shell islands. The habitat at the West Bay study site consisted primarily of large areas of smooth cordgrass (*Spartina alterniflora*) marsh.

Anecdotal information provided by commercial crabbers, resource biologist and terrapin enthusiasts suggested terrapins were more abundant than the trapping study indicated. Terrapin populations were reported in several areas of West Bay. In response to the anecdotal information, a supplementary field trip was conducted in May 1998. The trip was conducted at a site with a reportedly abundant terrapin population in West Bay. The field trip yielded the capture of 25 terrapins within a two-hour period. Terrapins were captured by hand in narrow tidal creeks within a large smooth cordgrass marsh.

The lack of diamondback terrapin captures by traps in West Bay when compared to Nueces Bay may be due to significant differences in habitat utilization and dispersal patterns between the upper and lower Texas coastal populations. Estimates of West Bay terrapin populations could not be determined by the data. Time of year, capture techniques and habitat characteristics are proposed to be major factors contributing to the negative result of the West Bay Study. Many questions of basic diamondback terrapin ecology along the Texas coast remain.

A HISTORY OF THE SCIENTIFIC MANAGEMENT OF SHRIMP IN THE GALVESTON BAY SYSTEM

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Environmental Historian and Research Assistant
Priscilla Weeks
Cultural Anthropologist and Research Associate
The Environmental Institute of Houston
University of Houston - Clear Lake

The Environmental Institute of Houston provided funding for this two-part project which chronicals the evolution of scientifically based management of the shrimp fisheries around Galveston Bay. Phase one was the research and collection of archival material that chronicled the historical, economical, scientific, and social data that relate to shrimp as one of Galveston Bay's sustainable natural resources. The second phase was to chronicle the evolution of the shrimping industry through oral histories, first-hand accounts, and acquired knowledge of the ecology of the Galveston Bay system.

The poster presentation of this project will consist of historical photographs illustrating the shrimping industry, historical scenes of Galveston Bay, the agencies involved with this industry, and excerpts from reports produced through the early research of those estuarine marshes considered important as shrimp nursery grounds.

Dickinson Bayou Wetlands: Community-Based Environmental Protection

Julie Massey
Texas Agricultural Extension Service
Texas A&M Sea Grant College Program
Dickinson, Texas
Marie Nelson
Galveston Bay Estuary Program
Webster, Texas

The Dickinson Bayou Wetlands: Community Based Environmental Protection Project is designed to increase community awareness of wetland values (economic and environmental) and losses. The project also will help the community to identify opportunities for wetland protection. To date, more than 202,000 citizens have learned about the project through slide programs, exhibits and news articles. The project was also featured on the local Public Broadcasting Station (KUHT) and as a poster presentation at the national "Communities Working for Wetlands" Conference held in Alexandria, Virginia in May, 1997.

Volunteers from several groups including the Galveston County Master Gardeners, students from McAdams Junior High and Sam's Club employees have participated in planting two wetland sites in the project area. These plantings and the associated education really make an impression on the volunteers. They not only get to feel, smell and sometimes taste the wetland; they also discover how a wetland performs a variety of functions such as serving as habitat or acting as a filter.

Fourteen Dickinson I.S.D. teachers participated in two three-day workshops which focused on using wetlands as an outdoor classroom. Future workshops for Realtors, local government and educators are planned and will include field activities.

HAVE YOU SEEN THIS PLANT?

Larry Hartman, Texas Parks and Wildlife Department, Jasper, Texas
Rhandy Helton, Texas Parks and Wildlife Department, Jasper, Texas
Ron Jones, U.S. Fish and Wildlife Service, Houston, Texas

Giant salvinia, *Salvinia molesta*, a State and Federally prohibited, aquatic plant has been found in the Houston area. Previously unknown from Texas, this noxious, floating aquatic plant has been identified from locations near downtown Houston; northeast Galveston county; northwest Harris county and most recently at Toledo Bend, the large Texas-Louisiana border reservoir. Capable of doubling its surface area in less than a week and creating vegetation mats a meter thick, Salvinia could become our next Water hyacinth. This plant prefers quiescent portions of lakes, ponds, wetlands, irrigation canals, and slow moving streams. Infestations block waterways and greatly reduce light penetration and oxygen levels. Human activities help spread salvinia and probably brought it to Texas. Since this species has been termed in the literature as "one of the worlds worst weeds", an effort is being made to educate the public as to the urgency to eradicate populations of this plant immediately.

EVALUATION OF MARSH CREATION/RESTORATION PROJECTS IN TERMS OF DESIGN CRITERIA AND MARSH DEVELOPMENT, GALVESTON BAY SYSTEM, TEXAS

Thomas R. Calnan, Texas General Land Office, Austin,Texas
William A.White, Bureau of Economic Geology, The University of Texas at Austin

Wetland loss as a result of natural processes and human activities in the Galveston Bay system and in other estuarine systems along the Gulf of Mexico is of continuing concern and highlights the need for designing and implementing marsh restoration and creation projects. There have been numerous efforts to restore, enhance, and create wetlands in the Galveston Bay system. Unfortunately, most have not been systematically monitored to determine their success. Among the objectives of this project were to analyze selected marsh restoration/creation projects to identify design criteria, and to evaluate marsh growth and potential for large-scale application. Funding for this study was provided by the U.S. Environmental Protection Agency.

Seven marsh restoration/creation sites in the Galveston Bay system were selected for analysis. Field surveys were conducted using a total station to determine land surface heights and slopes of created wetlands in relation to types of vegetation, percent cover, plant heights, vertical range in occurrence, hydrology, lithology of substrates, site stability, and exposure of shorelines to wave action. These analyses helped define the most successful criteria for marsh restoration and creation. Of the seven sites analyzed, two were primarily fill sites (where fill material is used to elevate the surface to intertidal levels), two were fill and shape sites, two were scrape-down sites (where the surface is cut down to achieve intertidal and subtidal elevations), and one was a natural substrate with shore protection.

Analyses of vegetation characteristics and land surface profiles indicate that the fill, and fill and shape sites had achieved the densest foliar cover, with percentages ranging in the 60s, followed by scrape-down sites with percentages in the 40s. Heights of *Spartina alterniflora* also varied. At many sites there was a high inverse correlation between height of the land surface and height of *Spartina alterniflora*. Along some transects this relationship was exponential, and along others linear. The average vertical range in land surface height on which *Spartina alterniflora* occurred varied from 25 cm to more than 60 cm. Although not as cost-effective, vegetation could be planted beyond its expected range and allowed to equilibrate with the mean intertidal range. A more cost-effective approach would be to plant at a narrower range with the expectation that transplants will spread and cover the normal tidal zone. At sites where organically rich fill material is used, wider plant spacings are more cost effective. In terms of substrates, frequently inundated organically rich muds (silt and clay) seem to have the most potential for relatively rapid growth and development of vegetation. In contrast, low-organic, dewatered Pleistocene clays at scrape-down sites may take time to become fertile enough for rapid spread of vegetation. Subsidence was a potential threat at all marshes investigated, but, in terms of shoreline stability, all sites had design criteria to guard against erosion.

Both scrape-down and fill sites, plus combinations of the two, have potential for large-scale development. Scrape-down sites are usually developed in uplands, so there is the potential of adding wetlands without displacing aquatic (bay bottom) habitats. In fill sites, vast quantities of dredged material from navigation channels provide a potential source of fill for large-scale development.

WETLAND LOSSES AND GAINS IN RESPONSE TO RELATIVE SEA-LEVEL RISE, GALVESTON AND CORPUS CHRISTI BAY SYSTEMS

William A. White, Bureau of Economic Geology, The University of Texas at Austin
Thomas A. Tremblay, Bureau of Economic Geology, The University of Texas at Austin

Variations in rates of relative sea-level rise along the Texas coast on the Gulf of Mexico have contributed to losses and gains in marsh habitats (emergent wetlands) since the 1950's. In the Galveston-Trinity Bay System, rates of relative sea-level rise have exceeded marsh vertical accretion rates, and vegetation has been lost by submergence. In the Corpus Christi Bay System, lower rates of relative sea-level rise have contributed to marsh expansion as formerly saline wind-tidal flats have become more frequently flooded and emergent vegetation has spread along the upper margins of the flats.

Using digital files available through the U.S. Fish and Wildlife Service National Wetlands Inventory (NWI) and related special programs, we analyzed spatial and temporal distribution of wetlands as part of two National Estuary programs (Galveston and Corpus Christi Bays). These analyses were supplemented by other wetland studies conducted by the Bureau of Economic Geology. Wetland distribution was based on aerial photographs taken in the 1930's, 1950's, 1979, and 1989-92. Changes in estuarine emergent wetlands (salt and brackish marshes) and tidal flats were the focus of the study. Rates of relative sea-level rise were determined from National Oceanic and Atmospheric Administration tide gauge and U.S. Geological Survey subsidence records.

GIS analysis of wetlands helped define the relationship between wetland trends and relative sea-level rise. Subsidence is a major component of the relative sea-level rise equation. Human-induced subsidence, resulting from withdrawal of ground water and oil and gas, has contributed to an accelerated rise of sea level that locally has exceeded 6 cm/yr in the Galveston Bay system along the northern coast. Here, thousands of hectares of salt and brackish marshes have been displaced by open water. In the Corpus Christi Bay system along the central coast, rates of relative sea-level rise are lower with long-term rates of less than 0.5 cm/yr and short-term rates less than 1.7 cm/yr. Although large areas of wind-tidal flats have been permanently submerged and converted to seagrass beds and open water, estuarine intertidal and palustrine marshes have expanded by thousands of hectares. There is evidence that maximum changes in marsh distribution in both geographic areas occurred between the mid-1950's and mid- to late-1970's, a period that coincides with a Gulf-wide increase in the average rate of relative sea-level rise.

Data and results presented were derived from studies by the Bureau of Economic Geology at The University of Texas at Austin, U.S. Fish and Wildlife Service, and Texas Parks and Wildlife Department. Funding for the Galveston Bay and Corpus Christi Bay National Estuary Programs was provided by the Texas Natural Resource Conservation Commission and U.S. Environmental Protection Agency.

WETLANDS RESTORATION AT GALVESTON ISLAND STATE PARK A MULTI-AGENCY PROJECT

Phil Glass, U.S. Fish & Wildlife Service, Houston, TX
Ted Hollingsworth, Texas Parks & Wildlife Department, LaPorte, TX

Galveston Island State Park included 1100 acres of tidal salt marsh, mostly smooth cordgrass *Spartina alterniflora* in 1930. The adjacent West Bay shallows contained large seagrass beds, probably *Halodule wrightii*. There were approximately 900 acres of marsh left when the tract became a state park in 1960. In the early 1990's biologist and fishermen noticed the marsh was rapidly disappearing. By 1994, aerial photographs confirmed there were only 400 acres remaining. Over the last 4 years, the marsh has disappeared, until today there are roughly 100 acres. West Bay's south shore tidal marshes are disappearing at an alarming rate, apparently from erosion precipitated by subsidence.

Biologists from Texas Parks and Wildlife Department secured a $2.1 million grant package from the National Coastal Wetlands Grant Program, Galveston Bay Estuary Program funds, and the Natural Resource Damage Assessment process process. The Galveston Island State Park Restoration Task Force is made up of members from Texas Parks and Wildlife Department, U.S. Fish and Wildlife Service, National Marine Fisheries Service, U.S. Army Corps of Engineers, Texas General Land Office, Galveston Bay Foundation, and Texas Natural Resource Conservation Commission.

The Task Force has collected aerial photographs, geotechnical and bathymetric data, and visited similar restoration sites along the Gulf Coast. Final project design and construction was contracted to Shiner and Moseley, Incorporated. The 404 permit was applied for during October 1998. Construction is to begin in January 1999, with planting scheduled for March 1999.

The goal is to create a protected mosaic of tidal wetlands, including low emergent marsh, high marsh, seagrasses, protected shallow-water habitat, and salt flats. These restored wetlands should achieve a diversity and productivity equaling that found in the historic marsh. Target species are shellfish such as blue crab, white shrimp, and brown shrimp; finfish such as spotted seatrout, red drum, and southern flounder; migratory game birds such as green-winged teal, northern pintail, and redhead; migratory shorebirds such as dowitcher, greater yellowlegs, and western sandpiper; and resident waterbirds such as great blue heron, willet, and clapper rail.

Specific restoration goals of the proposal are: intertidal marsh- 115 acres, seagrass beds-2 acres, salt flats-5 acres, and 2,500 linear feet of restored bay shoreline. Actual totals will depend on the final design and exigencies of the bidding process.

WETLAND AND AQUATIC HABITAT RESTORATION, JUMBILE COVE, WEST BAY

Jarrett "Woody" Woodrow, Texas Parks and Wildlife Department, Houston, Texas.
Cherie L. O'Brien, Texas Parks and Wildlife Department, Houston, Texas.
Will Roach, U.S. Fish and Wildlife Service, Houston, Texas.

Wetland habitats maintain the health and productivity of Galveston Bay by furnishing primary productivity in the form of detrital food for primary consumers and by furnishing habitat for most estuarine invertebrates and fishes. Up to 96 percent of commercial landings and 70 percent of recreational landings in the Gulf of Mexico are of species that are estuarine-dependent.

In 1930, 184 acres of Jumbile Cove was comprised of: 75 acres of intertidal marshes; 56 acres of tidal flats; 29 acres of lagoon/open water; and more than 24 acres of prairie (high marsh to uplands). Today, this area has been reduced and converted, as a result of subsidence and erosion, to: 35 acres of intertidal marshes; 18 acres of tidal flats; 116 acres of shallow open water; and 15 acres of prairie (high marsh). At the present rate of erosion, most of the remaining intertidal habitats will be gone within five years. Soft sediments, which formerly supported emergent vegetation at the cove, have disappeared, further reducing the ability of the marsh to recover from impacts.

The specific wetland habitat type to be restored as part of terracing, a matrix of sediment berms called terraces, is intertidal marsh. Earthen building material in the form of shell, stiff clays suitable for berm or levee construction, sand, fine-grained material usable for marsh creation, or a combination of these will be used to form the terraces and to restore elevations necessary for wetland creation. Materials adequate for building levees and wetlands are readily available onsite.

The immediate result of this project will be the creation of 52 acres of intertidal marsh. The presence of these berms will preserve the remaining 35 acres of intertidal marsh and 18 acres of tidal flat habitat. This project will also result in the accrual of increased aquatic habitat values by protecting 64 acres of tidal lagoon habitat. The berms will protect the interior water from winds and waves resulting in clearer waters, promoting the establishment of submergent vegetation.

The proposed project is a cooperative partnership between the Texas Parks and Wildlife Department, National Fish and Wildlife Foundation (Shell Marine Habitat Program), Galveston Bay Estuary Program, Houston Lighting and Power Company, Environmental Institute of Houston, and U. S. Fish and Wildlife Service, Galveston Bay Foundation.

Jarrett "Woody" Woodrow, Regional Coordinater, Upper Coast Conservation Office, Resource Protection Division, Texas Parks and Wildlife Department, 17629 El Camino Real, Suite 175, Houston, Texas, USA, 77058, (281) 461-4071, FAX (281) 488-1752.

THE PROPOSED REMOVAL OF THE BROWN PELICAN ALONG THE GULF COAST FROM THE ENDANGERED AND THREATENED SPECIES LIST

Edith Erfling
U.S. Fish & Wildlife, Clear Lake, Texas

The U.S. Fish and Wildlife Service is considering removing brown pelicans located in Mississippi, Louisiana and Texas from the federal list of threatened and endangered species. Like the bald eagle, the eastern brown pelican was once threatened with extinction due to the use of DDT and other organochlorine pesticides. Now, the eastern brown pelican is a familiar sight along the Texas and Louisiana Gulf coasts.

Nesting colonies of eastern brown pelicans, some containing over eight thousand birds, are scattered from Corpus Christi, Texas to New Orleans, Louisiana. In 1994, approximately 125 pairs of eastern brown pelicans nesting on Little Pelican Island in Galveston Bay produced 90 young. This marked the first time in over 40 years that the eastern brown pelican successfully nested in Galveston Bay. In 1998, an estimated 400 pairs of brown pelicans nested on Little Pelican Island.

The eastern brown pelican was listed as endangered in 1970 because of population declines caused by the use of the pesticide DDT and other organochlorine pesticides. By the time it was listed, less than 10 pairs of eastern brown pelicans nested in Texas. The only eastern brown pelicans in Louisiana were those restocked from Florida and their offspring.

Today, the nesting population along the Gulf coast is estimated at 14,000 pairs. Agency biologists know of no major threats to the eastern brown pelican. Protection, research, and recovery actions funded and carried out under the Endangered Species Act and the actions undertaken by the States have been essential to reestablishing and recovering the eastern brown pelican along the Gulf Coast.

SURVEY OF BENTHIC MACROINVERTABRATE AND MICROBIAL COMMUNITIES IN THE LOWER HOUSTON SHIP CHANNEL

Cynthia L. Howard, University of Houston - Clear Lake
Robert N. Ferebee, University of Houston - Clear Lake
Jennifer Reaves, University of Houston - Clear Lake

From May 1993 through March 1996, a portion of the lower Houston Ship Channel (HSC) between the San Jacinto River confluence and Morgans Point was studied to determine the diversity and productivity of macroinvertebrate and microbial fauna. Benthic and water samples were collected quarterly from six sites along the HSC and one station on the San Jacinto River, selected as non-point source areas. All samples were taken from the channel shelf at locations approximately equidistant from the channel pit edge and the shoreline.

Measured water quality parameters, which included dissolved oxygen, temperature, pH, and salinity, changed seasonally but remained within ranges deemed adequate for aquatic life throughout the study. The study period encompassed a significant flood event in November 1994 and a significant drought period in 1995-1996. These events were associated with abnormal salinity, pH and biological oxygen demand (BOD); however, these parameters returned to baseline when normal weather conditions were reestablished.

There was little variation in the abundance or diversity of benthic macroinvertebrates, neither among the sites nor across time. The most significant predictors of benthic macroinvertebrate abundance and diversity were the abundance and productivity of the microbial populations. Many benthic macroinvertebrates feed predominantly on microorganisms. Although the overall diversity of the benthic community in the lower HSC was similar to that found in other studies of the area, the species found most often in this study are recognized as indicators of disturbed environments.

Microorganisms populations were comprised of mostly heterotrophic aerobes, with some facultative anaerobes. Populations of sediment bacteria exhibited a desirable aerobic:anaerobic ratio and there was o evidence of euthrophication. BOD levels were elevated, indicating a high content of organic material.

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FIELD EVALUATION OF ECOTOXIC IMPACTS TO CLEAR CREEK

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In the Houston - Harris County region of Texas, most natural streams have been channelized over the past 50 years in an attempt to control flooding. Clear Creek, a 30-mile long meander emptying into Clear Lake and Galveston Bay, is the notable exception. Although still technically in its natural state, Clear Creek has been subjected to a number of toxic inputs from sources that include the brio Superfund Site, two waste treatment plants, and runoff from pastureland and residential areas.
In this study, we collected water, sediment and biota from three reference sites in Armand Bayou and 13 sites along the 14-mile reach of Clear Creek under consideration for channelization. Water, sediment and selected fish were analyzed for heavy metals by inductively coupled plasma spectroscopy (ICP) and atomic absorption spectroscopy, and for volatile organics (VOCs) and chlorinated hydrocarbon compounds by gas chromatography - mass spectroscopy (GCMS). Sediment toxicity was evaluated by two methods: (1) reduction of luminescence in *Photobacterium phosphoreum* using the Microtox® solid phase assay, and (2) chronic exposures of *Daphnia pulex* to elutriates from sediment resuspensions. The benthic macroinvertabrate diversity at selected sites was also studied. Our results indicate that sediments are contaminated in specific places along Clear Creek and toxic impacts to test species, as well as the natural community, are measurable.

THE ROLE OF STRESS PROTEINS IN POLLUTION TOLERANCE OF GRASS SHRIMP

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Contaminants-specific stress proteins (CSSPs) have been identified in estuarine organisms as biomarkers of pollutant exposure, and the role of these proteins as a mechanism for adaption to ambient pollutants is being investigated. This study compared CSSP induction and accumulation in the tissues of grass shrimp (*Palaemonetes pugio*) collected from 20 sites in Galveston and Matagorda Bays, TX. The sites were selected on the basis of known sediment contamination (e.g., mercury or oilfield brine) and were assigned to one of three groups: point source contamination, non-point source contamination, or reference. CSSPs were identified in homogenates of whole shrimp by polyacrylamide gel electrophoresis, and were quantified by imaging densitometry. Three test groups of grass shrimp were studied: (1) a group collected directly from each site in the field, (2) a group collected from each site in the field, then exposed to 96-hr cadmium challenge assays in the laboratory, and (3) a group of lab-acclimated assay controls.

Four contaminant-specific stress proteins were found to vary in grass shrimp among the collection sites, both in those evaluated directly from the field and those exposed to cadmium challenge. Grass shrimp collected from the point source contamination sites exhibited the highest survival rates in the cadmium challenge assays. These organisms also exhibited higher induction of two specific proteins under cadmium stress. However, maximum overall stress protein concentrations were found in grass shrimp inhabiting sites classfied as non-point source contamination. The results of this study provide evidence that CSSP induction and accumulation is positively correlated with ambient pollution tolerance in grass shrimp.

BAYPORT DEMONSTRATION MARSH - A BENEFICIAL USE OF DREDGE MATERIAL

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In 1993, the Port of Houston Authority, the U.S. Army Corps of Engineers, and the Beneficial Uses Group constructed the 220-acre Bayport Demonstration Marsh. The purpose for constructing the marsh was to identify key environmental and design parameters as well as monitoring and management requirements needed for the establishment, growth, and survival of 4,000 acres of future created marsh.

The overall project goal is through beneficial use of dredge material, create marshes that are ecologically similar to natural marshes located on Atkinson Island, Hog Island, and at Cedar Point in Galveston Bay as identified in the study entitled *Development of Desin Criteria and Parameters for Constructing Ecologically Functional Marshes in Galveston Bay, Texas* (Rozas et al 1995).

As an integral step in achieving this goal, monitoring and management of the Demonstration Marsh were proposed. Monitoring has been on-going on quarterly since 1995 after the Marsh was planted. This poster presentation will report on monitoring results since the immediate effects of construction activities have subsided and sufficient time has elasped to allow for plant establishment, channel formation, and tidal exchange to develop. Other physical conditions such as plant health, animal usage, and water quality parameters will be presented.

Monitoring and management activities are aided using aerial photography to tract the degree of marsh habitat development. Quantitative characteristics such as plant cover, density, diversity, and niche development can be determined from aerial photography interpretation. Further, the available historical record of high-resolution-repeat photographs allows for changes in the vegetative cover and marsh/water rations to be measured.

Monitoring assessment activities conducted over time allows for seasonal activity evaluations of marsh development and habitat use such as migration, spawning/nesting, and breeding. This presentation will highlight current marsh conditions, the level of function being achieved, and long-term informational needs regarding future marsh creation in Galveston Bay.

THE IMPORTANCE OF EPISODIC EVENTS ON TURBIDITY AND THE MOBILITY OF HEAVY METALS IN GALVESTON BAY

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Donald E. Harper, Dept. of Marine Biology, Texas A&M at Galveston

Episodic sediment resuspension events in estuaries (e.g., storms, shrimp trawling, or dredging) can substantially alter biogeochemical characteristics of the substrate and also reintroduce sediment particles and pore fluids into the water column. Such events are a control on the accumulation of sediment in the estuary and potentially allow the re-release of historically deposited contaminants. To elucidate the geological, geochemical, and biological impact of episodic events in Galveston Bay, we have begun (in Summer 1998) a three-year, Texas SeaGrant-funded assessment of the effects of shrimp trawling and wind storms on sediment resuspension. Shallow estuaries like Galveston Bay, where fine-grained bay bottom settings are only 2-4 m depth and the tidal range is relatively small, are dominated by wind-induced mixing that reduces stratification effects produced by estuarine circulation. Wind stresses are transmitted to the bottom in the form of direct wind-induced currents and wind waves, with the resulting benthic shear stress mainly controlled by fetch at the site. In spite of this highly energetic system, a large area of bay bottom habitat in Galveston Bay (~40%) is floored by fine-grained sediments from riverine input, shoreline erosion, marine sources, and internal (biological) production. Because of their capacity to adsorb inorganic and organic pollutants and the frequency of resuspension, these sediments constitute a potentially large and recurring source for toxic materials entering the estuarine water column. The major objective in this study is to determine the relative importance of these natural sediment resuspension mechanisms with anthropogenic effects such as shrimp trawling, and to elucidate their importance in promoting the release or recycling of associated components.

The first year of the research is focused upon the effects of shrimp trawling, and its impact on seabed sediment character and benthic biology and geochemical perturbations on sediment-water transport. Trawling resuspension experiments are underway using local fisherman in a variety of bottom habitats and seasons. Boundary-marked study and control grids will be established and monitored before, during, and for regular intervals after controlled trawling. Investigations will include water column properties (e.g., turbidity, salinity, temperature, current speeds, etc.), seabed character (e.g., shear strength, grain size and sorting, porosity), abundance and diversity of benthic organisms, geochemical seafloor properties (dissolved O_2, pore water nutrient and metal concentrations, mixing and accumulation rates of ratioisotopes), and seabed fluxes of pore water constituents. Year 2/3 will concentrate on measuring the chemical flux rates and turbidity response caused by natural episodic events (e.g., winter storms, summer maritime winds, and possibly, tropical storms) using bottom-deployed instrument packages combined with site characterization. Quantification of natural and anthropogenic resuspension effects will provide information for agencies, managers, and scientists to: 1) better balance water quality and long-term Bay health issues with the benefits of the shrimping industry; 2) better determine the fate and environmental hazard of heavy mineral species; and 3) better model the sediment dynamics and cycling of chemical species (including nutrients) in shallow estuaries.

SPRING SHOREBIRD USE AT BRAZORIA NATIONAL WILDLIFE REFUGE COMPLEX, TEXAS

Richard T. Speer, USFWS, Angleton, TX

Shorebird surveys were conducted from March through May of 1993 and 1994 at Brazoria National Wildlife Refuge (NWR) Complex, located along the upper coast of Texas and consisting of Brazoria, San Bernard, and Big Boggy NWRs. Thirty-three species of shorebirds were observed and the greatest shorebird abundance occurred during late April of both years. Dowitchers (Limnodromus spp.) and lesser yellowlegs (Tringa flavipes) were the most abundant migrants. In 1993, the largest shorebird concentrations were associated with lesser snow goose (Chen caerulescens) eat-out areas in saltmarshes, and secondly with tidal mudflats. In 1994, due to more favorable habitat conditions, shorebird concentrations were more evenly distributed in brackish marshes, tidal mudflats, and snow goose eat-outs. Sizable concentrations also occurred in dredged spoil disposal impoundments along the Gulf Intracoastal Waterway. Freshwater impoundments received relatively little shorebird use, because of heavy vegetation and lack of a dependable water supply. As a result of these surveys, the Brazoria NWR Complex is now classified as an International Shorebird Site by the Western Hemisphere Shorebird Reserve Network (WHSRN).

DEVELOPMENT OF A BLACK SKIMMER AND LEAST TERN NESTING SITE AT BRAZORIA NATIONAL WILDLIFE REFUGE

Richard T. Speer, USFWS, Angleton, TX

During January of 1995 a black skimmer (Rynchops niger) nesting area was developed on an abandoned gas well drilling pad at Brazoria National Wildlife Refuge. Black skimmers traditionally nest on shell islands and beaches in the surrounding bays. These natural nesting sites are often destroyed by high tide waters or predators. The elevation at the drilling pad was high enough to avoid flooding from most high tide situations, while still providing close proximity to feeding areas. Half of the area was covered with gravel and half with oyster shell. A chain-link predator fence armed with two electric wires was built around the area to exclude predators. Black skimmer decoys were placed on the area to initially attract the birds. Surveys were conducted throughout the nesting seasons of 1995 and 1996. Black skimmers, least terns (Sterna antillarum), and gull-billed terns (Sterna nilotica) nested on the site both years. Thirty-five black skimmers in 1995 and 93 in 1996 were noted as nesting during the annual waterbird colony census during early June of both years. Least terns numbered 110 during 1995 and 111 during 1996. Gull-billed terns numbered 15 and 23 in respective years. Black skimmers and gull-billed terns seemed to prefer nesting on the oyster shell, while least terns nested more on the gravel.

LAFITTE'S COVE WATER QUALITY MONITORING PROGRAM IN GALVESTON BAY, TEXAS

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Texas A&M at Galveston under contract to the Mitchell Development Corporation of the Southwest has monitored water quality in Galveston Bay's Eckert Bayou watershed since 1990. Completion of canals to expand the original Pirate's Cove waterfront housing development into Lafitte's Cove subdivision in December 1992 required increased remote and in-situ water quality monitoring efforts. Two stations were utilized, one in a natural marsh adjacent to the existing subdivision and one in the newly dredged waterfront housing canal. Numerous hydrographic (water temperature, salinity and dissolved oxygen), biological (total coliform) and chemical parameters (nitrate nitrogen, total phosphorous and chlorinated hydrocarbons) have been monitored at varying frequencies during 1 June through 15 September of each year since completion of the canals. The potential for impaired water quality through lawn development and associated nutrient runoff is heightened by continued waterfront development in this watershed. To date, monitoring efforts show comparable water quality at both the natural marsh and dredged canal stations. However, increased occurrence of elevated nutrient levels mandate continued monitoring throughout the development of Lafitte's Cove subdivision.

GALVESTON BAY'S DISAPPEARING BIRD ISLANDS

Winifred Burkett, Texas Audubon, Friendswood, TX
Robert Gallaway, Texas Audubon, Bacliff, TX

The colonial waterbirds -- pelicans, cormorants, herons, egrets, ibis, spoonbills, terns and gulls -- of coastal Texas nest on islands in the various bays. Islands provide realtively predator-free locations close to food sources that the birds feed their young. Historically, there were numerous natural islands in Galveston Bay that were used as nesting sites by colonial waterbirds. These were augmented by man-made islands created by the dredging of navigation channels. A number of the natural and man-made islands have been lost due to the combined impacts of sudsidence, erosion and sea level rise. Currently all of the bird islands ae eroding rapidly. If Galveston Bay is to continue to support a healthy colonial waterbird population, creative methods need to be found to protect the remaining islands in the bay.

BROWN PELICAN'S RETURN TO GALVESTON BAY

Winifred Burkett, Texas Audubon, Friendswood, TX
Robert Gallaway, Texas Audubon, Bacliff, TX

Brown Pelicans (Pelicanus occidentalis) disappeared from Texas as a breeding bird during the 1950's. The principal causes of the disappearance were beleived to be the pesticides DDT and dieldrin, and harassment by man. DDT wa outlawed in 1972 but its use had declined substantially prior to that date. Brown Pelicans returned to Texas as a breeding species in 1973. Adult and immature pelicans became more abundant over the years but they did not resume breeding in Galveston Bay until 1991. During the 1998 breeding season 329 pelican nests were counted on Little Pelican Island in Galveston Bay.

BIOAVAILABILITY OF COLLOIDAL MATERIALS TO BIVALVES IN GALVESTON BAY WATERS

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Bivalves such as oysters and mussels are important fisheries resources in Galveston Bay. These bivalves are uniquely capable of concentrating contaminants from large volumes of estuarine waters that they filter. Therefore, they have been used as pollution indicator organisms in environmental assessment and monitoring programs by federal agencies for several decades. Thus, it is important to study the assimilation and bioaccumulation of metals and other pollutants in these bivalves. Previous studies examined the toxicity and bioavailability of metals to oysters and mussles with respect to either "dissolved" or particulate forms. However, the traditionally defined "dissolved" phase contains a considerable portion of colloidal forms, i.e., metals associated with organic mactomolecules and microparticles. In addition, these fine-size colloids (or submicron particles) have been found to be abundant in estuarine and marine environments. Due to their abundance in aquatic environments and their unique physiochemical properties such as high specific surface areas and high complexing capacities, colloids may play important roles in the assimilation and accumulation of toxic metals and other pollutants in estuarine bivalves. However, the role of colloids in metal bioavailability and toxicity to bivavles has never been studied systematically. In the present study, we used laboratory experiments combined with radiotracer, ultrafiltration and clean techniques to examine whether the presence of collloidal materials (mainly colloidal organic matter) alters the bioavailability and toxicity of metals to these estuarine bivalves under different conditions. Our preliminary results demonstrate that oysters and mussles can indeed filter submicron particles out of the water during cultural experiments. Thus, "dissolved" toxic metals and other pollutants, which are mostly associated with colloidal materials in estuarine waters, will also be ingested by these bivalves. Results on the assimilation and depuraton rates of colloid-associated with colloidal materials in estuaring waters, will also be ingested by these bivalves. Results on the assimilation and depuration rates of colloid-associated metals (Hg, Ag, Zn, Cd, Co, Fe, Mn, Ba, and Se) in oysters and mussels in Galveston Bay from recent experiments will be presented.

USGS/H-GAC Study to Characterize Water and Sediment-Quality in Christmas Bay, Brazoria County, Texas, 1998-1999

The Christmas Bay system is a group of three small secondary bays at the southwestern extreme of the Trinity-San Jacinto estuarine system in Brazoria County, Texas. The three-bay system, including Christmas, Bastrop and Drum Bays, lie inland of a barrier island, Follets Island, southwest of West Bay and San Luis Pass. The three bays are bordered on the west by the 12,199-acre Brazoria National Wildlife Refuge (BNWR). The Christmas Bay Coastal Preserve is also within the jurisdiction of the Galveston Bay Estuary Program (GBEP) of the Texas Natural Resource Conservation Commission (TNRCC). The Christmas Bay system is inhabited by numerous species of birds, fish, crustaceans, and mollusks. These biota include 7 endangered species of birds and an endangered species of sea turtle. Numerous flora also occur in the Christmas Bay system including several species of seagrass that serve as a prime spawning ground for crustaceans and finfish. Freshwater inflows to Christmas and adjacent bays comes mostly from the Bastrop Bayou watershed (TNRCC segment 1105) and Salt Bayou within the San Jacinto-Brazos Coastal Basin. Another hydrodynamic input to the Christmas Bay system is the Gulf Intracoastal Waterway (GIWW). The GIWW makes a path through BNWR, across the southern part of the Bastrop Bayou watershed and the Christmas Bay system from southwest to northeast. It is unknown what possible effects may occur in Christmas Bay as these watersheds develop. Previous water-resource investigations of the area have been only reconnaissance in nature, including a contaminant study of benthic macroinvertebrates, finfishes and sediments in Christmas Bay. TNRCC collects water-quality and sediment-contaminant data from each of the bays on a quarterly basis as part of the State's water-quality monitoring program. TNRCC and GBEP have indicated a need for baseline water-quality and sediment-quality information and updated maps of seagrasses in Christmas Bay.

The overall goal of the current USGS/H-GAC study is to develop an improved understanding of water-quality and hydrologic conditions of the Christmas Bay system and to provide baseline environmental information in this ecologically sensitive bay system. The study is directed towards the collection of a selected spectrum of baseline data, including information on water-quality and hydrologic conditions, during a 12 month period. These data include seagrass bed locations, and selected water-quality and sediment-quality parameters and constituents, as well as data that will be used to define meteorological conditions and the hydrodynamics of the estuarine system. Water-quality samples will be collected at six locations, sediment-quality samples will be collected at three locations, and meteorological data will be collected at one location. In addition, discharge measurements will be made at six locations. A project work plan which contains a comprehensive Quality Assurance Project Plan (QAPP) that meets H-GAC and TNRCC specifications, will be prepared and available before data collection activities begin. In general, quality assurance / quality control will be carried out in two phases encompassing both laboratory and field procedures.

Characterization of the data will be performed through graphical and statistical methods. Upon completion of the study, a U.S. Geological Survey Fact Sheet will be prepared to present a summary of project data and interpretations of these data. Geographic Information System (GIS) coverages of project data will be prepared and archived. Additionally, all data collected and compiled for the study will be formatted and made available on an appropriate electronic media as well as from the

Internet. In particular, water-quality data collected at a fixed-station in Christmas Bay will be provided near real-time through the USGS Home Page throughout the duration of the study.

Development and Construction of a Freshwater Treatment Wetland and an Intertidal Wetland Adjacent to the Houston Ship Channel.

Quast, W.D.
Chang, C.
Murray, J.L.
Davidson, R.L.
Kovski, J.R.
Williams, G.

Quast, W.D.*[1]; Chang, C.C.[2]; Murray, J.L.[3]; Davidson, R.L.[1]; Kovski, J.R.[2], Williams, G.[2]. In the past, extensive shoreline modification and poor water quality in the Houston Ship Channel (HSC) discouraged utilization of the waterway by aquatic biota. While water quality in the HSC has improved and some species of finfish and shellfish have returned to the system, habitat suitable for the growth and development of estuarine biota (intertidal wetlands) is scarce. The purpose of this project was to construct a system of wetlands that would increase the availability of high quality intertidal habitat adjacent to the waterway, and improve the quality of a treated effluent stream that is discharged to the waterway. A 7 hectare wetland with three hydraulic connections to the HSC was constructed to provide intertidal habitat for fish, shellfish, wading birds and other wildlife. The constructed wetland consists of intertidal marsh, high marsh, and transitional upland. At a higher elevation on the same site, a 6.9 hectare freshwater treatment marsh was constructed. The treatment marsh consists of a series of deep pools and shallow planting shelves along a meandering water-course. The marsh was primarily designed to reduce ammonia levels in a treated effluent stream. Shallow grassbeds and open water pools in the marsh will also provide high quality habitat for birds and terrestrial wildlife. When fully developed, this wetland system will provide habitat and sustenance for wildlife in the HSC, where high quality habitat is rare, and will further improve the quality of an effluent stream discharged to the waterway.

[1] Benchmark Ecological Services, Inc.; [2] Radian International LLC; [3] Agrifos Fertilizer L.P. (formerly Mobil Mining and Minerals Company).

Restoration of Intertidal Wetlands Along the I-45 Corridor - Galveston, Texas.

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Evangeline L. Whorton, Chairperson - Scenic Galveston, Galveston, TX.

Scenic Galveston, in cooperation with ENTRIX, Inc. of Houston, Texas is currently reclaiming, restoring, and enhancing severely degraded acreage associated with an above-ground earthen-levee dredge material containment area and two subtidal borrow pits along the I-45 corridor immediately north of the Galveston Causeway. The objective of the proposed project is to reduce the landfill and associated access roads to an elevation suitable for the planting and successful propagation of smooth cordgrass, *Spartina alterniflora,* and reclaim as much additional land as possible for smooth cordgrass planting through the partial filling of the borrow pits with landfill materials. The restoration of these wetlands is one part of a three-phase project, initiated in 1993, to permanently acquire and protect almost 900 acres of wetland habitat for migratory waterfowl and other wetland-dependent species, including threatened and endangered species. In addition to the creation of highly productive estuarial wetland habitat, this restoration will greatly enhance the aesthetic qualities of the approach to Galveston Island by removing a development eyesore.

EFFECTS OF BIVALVE FEEDING ON THE BIOMASS AND COMPOSITION OF NATURAL MARINE PLAKTON COMMUNITIES

Kristina Faulk

In large shallow estuaries with relatively high water residence times, such as Galveston Bay, macrobenthic filter feeders, especially bivalve mollusks, are estimated to play a major role in phytoplankton herbivory. Little is known about bivalve feeding selectively on natural plankton populations and its effect on plankton community structure. During September and October 1998, oysters Crassostrea virginica and mussels Ishadium recurvum were isolated independently in test chambers and the plankton community was examined in both inflow and outflow water. The plankton samples taken before and after exposure to bivalve feeding activity were then tested for differences in plankton concentrations and composition.

AN EXAMINATION OF BOTTLENOSE DOLPHINS (*TURSIOPS TRUNCATUS*) IN THE GULF OF MEXICO USING MORPHOMETRICS AND HEMOGLOBIN PROFILES: A COMPARISON OF TECHNIQUES

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Bottlenose dolphin, *Tursiops truncatus*, populations are at risk in the Gulf of Mexico from die-off or mortality events, and possible permitting to remove animals for marine parks and fisheries interactions. Management of *Tursiops* in the Gulf of Mexico is complicated due to discrepancies in the taxonomy of the genus. The most widely accepted taxonomic classification is that of a single species, *Tursiops truncatus,* though up to four other species appear in the literature. Several techniques, including cranial morphometry, hemoglobin electrophoretic profiles, and mitochondrial DNA (mtDNA) restriction fragment length polymorphisms (RFLP) and sequencing, have been used to distinguish possible species and subspecies differentiation.

A total of 212 skulls of stranded bottlenose dolphins were examined to assess geographical variation of morphological characters. Thirty-five cranial measurements were examined along with age, sex, standard length, skull maturity, and geographic location of stranding. A group of Atlantic offshore (n=13) and Pacific animals (n=9) were used as outgroups, due to their genetic similarity to offshore animals from the Gulf of Mexico. A group of three Gulf of Mexico dolphins was found within the sample ellipse of the Atlantic offshore and Pacific animals during statistical analysis, while the rest of the Gulf animals were grouped with known inshore animals.

Hemoglobin profiles of a subset of the Gulf of Mexico animals (n=50) used in the morphometric study were examined to compare the results of the two techniques. Hemoglobin results for Atlantic *Tursiops* detected two electrophoretic phenotypes, which are reported to distinguish inshore form offshore stocks. In samples from the Gulf of Mexico, three electrophoretic phenotypes have been detected. The relationship between electrophoretic and morphometric phenotypes will be discussed.

Further analysis will attempt to compare the results of the present study with that of a mtDNA D-loop assessment of the same subset of animals.

OYSTER GROWTH ON AN ARTIFICIAL SUBSTRATE

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In Phase I of, "Oyster Growth on an Artificial Substrate" it was found that there were a sufficient amount of oysters growing on a Galveston Bay coal ash reef available for commercial harvest. The reef was bulk with coal combustion by-product pellets (CCB). CCB material is the ash reminisce left after burning coal combustion by-product pellets (CCB). CCB material is the ash reminisce left after burning coal for electricity. The reef was divided in to three sections: North, Central, and South. Thirty pellet samples of each section were measured to determine a sectional average oyster size. Pellet samples consisted of a randomly selected coal ash pellets with live oysters attached to them. It was my hope that an average size would show the success of oyster growth reef. A successful reef would be able to sustain population levels during periods of commercial harvest. Phase I revealed the existence of oysters, but not trends of growth or population.

Phase II was conducted with an almost identical procedure. The differences between the two studies were, the length of the collection period and the way in which the data was analyzed and presented. In analyzing each sections sample individually it was determined that each section exhibited similar growth trends. A noticeable growth pattern enabled the data to be combined from each section every month; thus having ninety pellet samples rather than a thirty pellet samples each month. Through analyzing the data in this manner monthly growth trends were determined. Finding and predicting growth trends are important for population control. In the future these trends could be used to regulate and control harvesting of the coal ash reef.